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ORIGINAL ARTICLE

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Pharmacist-led, video-stimulated feedback to reduce prescribing errors in doctors-in-training: A mixed methods evaluation

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Aims: To develop and evaluate a feasible, authentic pharmacist-led prescribing feedback intervention for doctors-in-training, to reduce prescribing errors.

Methods: This was a mixed methods study. Sixteen postgraduate doctors-in training, rotating though the surgical assessment unit of 1 UK hospital, were filmed taking a medication history with a patient and prescribing medications. Each doctor reviewed their video footage and made plans to improve their prescribing, supported by feedback from a pharmacist. Quantitative data in the form of prescribing error prevalence data were collected on 1 day per week before, during and after the intervention period (between November 2015 and March 2017). Qualitative data in the form of individual semi-structured interviews were collected with a subset of participants, to evaluate their experience. Quantitative data were analysed using a statistical process chart and qualitative data were transcribed and analysed thematically.

Results: During the data collection period, 923 patient drug charts were reviewed by pharmacists who identified 1219 prescribing errors overall. Implementation of this feedback approach was associated with a statistically significant reduction in the mean number of prescribing errors, from 19.0/d to 11.7/d (estimated to equate to 38% reduction; $P < .0001$). Pharmacist-led video-stimulated prescribing feedback was feasible and positively received by participants, who appreciated the reinforcement of good practice as well as the opportunity to reflect on and improve practice.

Conclusions: Feedback to doctors-in-training tends to be infrequent and often negative, but this feasible feedback strategy significantly reduced prescribing errors and was well received by the target audience as a supportive developmental approach.

KEYWORDS

clinical pharmacy, medical education, medication errors, patient safety, prescribing

PI statement: The authors confirm that the Principal Investigators for this paper are Karen Mattick and Rob Bethune, and Rob Bethune had direct clinical responsibility for patients.

1 | INTRODUCTION

Prescribing errors are common in healthcare settings. Defining what counts as a prescribing error is challenging but generally includes transcription errors, failures to communicate essential information, and the use of drugs or doses inappropriate for the individual patient.[1] Different studies report different levels of prescribing error (e.g.[2,3]), reflecting true variations and differences in definitions and study designs. For example, in Ashcroft et al.'s study,[2] the mean error rate was 8.8 errors per 100 medication orders; and in Seden et al.'s study,[3] 1 or more error was observed in 43.8% of prescriptions. Despite the interpretation challenges,[4] such figures are alarmingly high and it is clear that a subset of these errors pose a real threat to patient safety. Doctors-in-training are an important group to support in developing their prescribing capabilities. They are reported to be underprepared for their prescribing responsibilities upon graduation[5] and yet shoulder a large proportion of the prescribing activities within hospitals in UK settings and beyond.[2] Therefore if prescribing amongst doctors-in-training could be improved, there is significant potential to reduce prescribing errors and improve patient safety.

Unfortunately, prescribing practices are hard to change. Although usually attributed to an individual prescriber, it is increasingly clear that prescribing errors are typically multifactorial, involving multiple people working in a complex, interrelated and fast-moving healthcare systems.[6-9] This means that solutions that focus on a single cause, such as a knowledge deficit, are likely to lead to limited benefits.[7,10,11] The social elements of healthcare team working are increasingly recognised as important in relation to prescribing errors.[8,12-15] Thus, doctors-in-training need to learn how to liaise productively and sensitively within a team that includes a range of healthcare professionals of different grades, in order to achieve the best outcomes for patients.[16] The medical hierarchy has been identified as a particular challenge for junior professionals to overcome, with medical trainees often reluctant to question senior colleagues.[6,8]

Feedback is an intervention with substantial promise to improve the prescribing capabilities of doctors-in-training, having already been demonstrated to make a significant positive impact on other important educational and healthcare outcomes.[17-20] Feedback can allow activities in real practice settings to be reviewed in a holistic way by experts, which can promote meaningful behaviour change. Although professional bodies state that doctors-in-training should be provided with regular feedback on their prescribing practices in a structured and supportive way,[21] in practice doctors-in-training report infrequent and/or suboptimal feedback, for various reasons.[15] Feedback appears to be most effective in healthcare settings when the recipient has a low baseline performance (as might be expected with doctors-in-training), when it is given by a supervisor or colleague, when it is given more than once, and both verbally and written, and when it results in an action plan.[17] In relation to prescribing errors specifically, feedback appears most effective for learning when it is timely, and provides a comprehensive, contextualised benchmark from which the prescriber can compare their prescribing behaviours and current level of knowledge.[22]

What is already known about this subject

- Feedback can be an impactful educational intervention.
- Doctors-in-training represent the largest group of hospital prescribers but rarely receive feedback on prescribing.
- Pharmacists, as medication experts and established members of clinical teams, are well placed to support the development of good prescribing in doctors-in-training.

What this study adds

- Implementing a well-designed feedback intervention can reduce prescribing errors substantially (we estimate by 38% in our study; $P < .0001$).
- Supportive feedback may be positively received by doctors-in-training as a means to improve their practice.
- Such interventions need not be expensive, with time investment in giving feedback balanced by the errors prevented.

Having identified feedback to doctors-in-training as a useful intervention type, it is also increasingly apparent that pharmacists are well placed to help. Pharmacists are established members of the clinical team with expertise that is relevant to the prescribing of medications. Importantly, they sit outside the medical hierarchy, and have been suggested as well placed to support and develop the prescribing practices of doctors-in-training (e.g.[9,15]). Recent research from Australia highlighted significant potential for co-working between doctors-in-training and pharmacists to develop effective prescribing practices, for example through pharmacists developing roles in learning facilitation rather than error identification.[16] McLellan et al. demonstrated that a structured feedback session for doctors-in-training facilitated by pharmacists based on real patient cases increased rates of appropriate antimicrobial prescribing.[9] Importantly, Noble et al.[23] advocated greater emphasis on interprofessional collaboration for learning in everyday activities and interactions, rather than more traditional approaches to education which often occur beyond the everyday work setting. Therefore, we developed a model of pharmacist-led feedback for doctors-in-training that was embedded within their work environment and aligned to their everyday prescribing tasks.

2 | METHODS

2.1 | Aim

To develop and evaluate a feasible, authentic pharmacist-led prescribing feedback intervention for doctors-in-training, to reduce prescribing errors.

2.2 | Project design

This mixed-methods study, with a convergent design, combined quantitative data in the form of prescribing error prevalence data measured each week before, during and after the intervention period; and qualitative data in the form of semi-structured interviews with a subset of participants who took part in the project. To maximise the likelihood of success, the feedback intervention was co-designed by the authors (3 pharmacists, a consultant surgeon and a professor of medical education) and other key stakeholders (including pharmacists, patient representatives, a doctor-in-training and a consultant microbiologist), incorporating knowledge from the published literature. For example, given the knowledge mobilisation literature that highlights the challenges of transferring learning to practice,[24] we provided feedback in real clinical settings in relation to real patients that the doctor-in-training had seen. The principles underpinning the design were to: maximise authenticity by embracing the complexity of practice; maximise timeliness and relevance of feedback for participants; and minimise cost to ensure feasibility. The feedback approach was refined through iterative rounds of piloting, incorporating feedback from a variety of healthcare professionals from a range of settings.

2.3 | Participants and setting

Participants were doctors-in-training, 1–4 years postgraduation, rotating through the Surgical Assessment Unit (SAU) at a National Health Service teaching hospital in Southwest England. The SAU was selected because a large proportion of doctors-in-training rotate through this setting; they tend to work more autonomously as surgeons are often not physically present on the ward; and there was good buy-in for the project from senior clinicians in that setting for our project. Recruitment was led by a middle-grade pharmacist (O.F.), who was already known to the participants since he was the pharmacist allocated to that ward, from November 2016 to February 2017. All potential participants were provided with written and verbal information about the project. Subsequently, participants were asked to sign a consent form if they wished to participate, with assurances that there would be no negative impact on their reputation or access to training if they declined. Patients also gave their written consent to be involved. The project was deemed quality improvement by the trust Clinical Research Advisor, and therefore did not require formal ethical approval. It was discussed and approved via the appropriate Trust governance groups.

2.4 | Approach to filming

A pharmacist (O.F.) identified potentially suitable patients during their routine clinical practice and explained the purpose of the project. Patients were eligible to be involved in the study if they were on 4 or more medications; were clinically stable and not confused; and were willing to participate. Once a suitable patient was available, the pharmacist introduced the doctor participant to the patient; gave a brief summary of the patient's presenting complaint; set up the camera with the image trained on the doctor-in-training; and asked the doctor to complete a medication history and prescribe appropriate medication for the patient including any necessary antibiotics (in the same way they would in a normal clinical encounter). Doctor participants were provided with a drug chart and a medications reconciliation clerking proforma which forms part of the routine clerking paperwork. Where prescribing happened remotely from the patient consultation, this was also recorded. Doctors typically relocated to the nurses' station to complete patient drug charts.

2.5 | Feedback sessions

Feedback sessions occurred within 3 days of filming, at a mutually agreeable time and location for the doctor participant and pharmacist. Prior to the feedback session, the pharmacist watched the video footage (typically 15–20 minutes); checked the patient's medication history; and reviewed the clinical information and drug chart. Feedback sessions typically lasted 30–45 minutes and took place in a meeting room. The pharmacist reiterated the project's aims and the consultation/prescribing footage was reviewed together and discussed. The feedback process was supported by a purpose-made feedback conversation schedule (see Supplementary Information), underpinned by Self-Regulated Learning theory.[25,26] Self-regulated learning involves metacognition (thinking about one's own thinking), strategic action (planning and evaluating activity against a standard), and motivation for learning. This theory was selected for this study due to its ability to empower participants to evaluate their clinical practice and learning needs. At the end of each session, the doctor and pharmacist developed and agreed an improvement plan.

2.6 | Prescribing error data (quantitative)

A pharmacist (O.F.) collected prescribing error data once a week, on the post-take surgical ward round and during routine practice/ward work on the SAU. The data collected included: the number of patients seen; number of patients with a venous thromboembolism risk assessment completed and prophylaxis appropriately prescribed; number of patients on antimicrobials and whether these prescriptions were compliant with local prescribing guidelines (i.e. were appropriately documented and compliant with local guidelines or targeted to sensitivities); number of patients with correctly documented allergy status; and the number of pharmacist interventions made. For the purposes of this study, each pharmacist intervention was considered to equate to a prescribing error: this included use of drugs or doses inappropriate for the individual patient, transcription errors, ceasing of antibiotic prescriptions that are no longer required and failures to communicate essential information (e.g. venous thromboembolism assessment, antimicrobial indications or review/stop dates, correct patient allergy status). The approach to measurement was exactly the same in the baseline, test and sustain phases and so the data are directly comparable, but data on error severity were only available after the feedback intervention was introduced. Where a prescribing error meeting the definition provided by the EQUIP study[27] was identified, a detailed description of the error was documented. This

included: details of prescribing error; the medication involved; the prescriber's grade; and the risk of harm posed by the prescribing error using the severity error classification scheme from the EQUIP study.[27] Prescribing error data were then collated in a Microsoft Excel spreadsheet and analysed using a statistical analysis program for statistical process control charts (the Life System: https://uk.lifeqisystem.com/). An I-chart was used and statistical significance was tested using Nelson's rules.[28]

2.7 | Semistructured interview data (qualitative)

A subset of the doctor participants (n = 6) attended a semistructured interview, which aimed to gain an understanding of the participant's experiences of the feedback intervention. Given the richness of the data, this number was sufficient to meet the aim of providing further insights into the feedback process. The 6 doctors were purposively selected to maximise variation by O.F. and K.M., based on their demographic data (e.g. sex, stage of training) and/or the nature of their feedback intervention (e.g. patient characteristics, nature of the feedback), to ensure representation of a wide range of feedback intervention experiences. Interviews were conducted by a Professor of Medical Education (K.M.) who was not involved in participant recruitment or the feedback session, to encourage participants to speak freely about their experience of the feedback intervention. The doctors were asked to describe their experience of being involved in the feedback intervention, from start to finish, with questions from the interviewer prompting a more in-depth account where necessary. Each interview typically lasted 25 minutes and was conducted at a mutually convenient time and location. Interviews were audio-recorded, transcribed verbatim and analysed using an inductive thematic analysis approach to identify key concepts and topics.

3 | RESULTS

3.1 | Participants

Sixteen (9 male, 7 female) of the 25 doctors-in-training, rotating through the SAU and given the opportunity to participate, completed the intervention. They had an age range of 23–31 years and had all had been working as a doctor for <4 years.

3.2 | Prescribing errors

Prior to the study, the pharmacist reviewed 682 patients over 50 days leading to 950 pharmacy interventions (each relating to 1 prescribing error). During the implementation phase, 241 patients were reviewed over 23 days leading to 269 interventions. Pharmacist interventions postintervention included correction of serious prescribing errors; cessation of inappropriate prescriptions e.g. antimicrobials; dosage alterations to account for renal/liver function; allergy status corrections; alteration to the route of administration; the addition of overlooked regular medication; and requests for the completion of venous thromboembolism risk assessments and prescribing of appropriate prophylaxis. Implementation of the prescribing feedback initiative led to a significant reduction in prescribing errors (Figure 1). The mean number of prescribing errors reduced from 19.0/d to 11.7/d representing an estimated 38% decrease overall (P < .0001) and 20% less errors per patient (Table 1). The statistical process chart demonstrated that this was a statistically significant change with a false negative rate of <6.5%.[29] Interpretation of this decrease makes the assumption that the number of patients (and therefore average number of prescriptions written) was stable throughout the evaluation period but the weekly patient admissions data for the Surgical Admissions Unit over the same period show a backdrop of increasing patient numbers, rising from 51.0 during the baseline period, to 62.8 during the test period and 69.1 during the sustain period (Figure 2). This means that the estimated 38% error reduction may be understating the true benefits of the intervention. While the majority of the 269 prescribing errors posed little risk of harm to the affected patients, we were able to identify errors at all levels of severity according to the severity of error classification scheme used by the EQUIP study, including some that were potentially fatal and some that posed a significant risk of harm (see Table 2). The prescribing errors predominantly related to regular medicines (medicines the patient was taking when admitted to hospital) rather than those initiated on admission, although this might simply reflect the relative proportions.

3.3 | Participant experiences

The themes arising from the analysis including acceptability, authenticity, experience of filming and feedback, and commitment to behaviour change (Table 3). Participants commented on the acceptability of the intervention, particularly their experience of being videoed on the ward. In general, although they were conscious of it, being videoed did not pose a barrier to participation for doctors-in-training or patients (Table 3, topic 3.1). Some participants felt that this awareness meant that they were more thorough in their history taking than usual (Table 3, topic 3.1), although others said that it did not affect the way they worked. Patients appeared happy to be involved in the project. This may partly be due to the fact that many were waiting for scans, test results, operations or to be discharged, and so it offered a way of passing the time. Doctor participants also commented on the authenticity of the task they were asked to complete (Table 3, topic 3.2). Many reported that the brief they were given, to take a medication history from a patient and write up a drug chart, was a very typical activity. Participants were overwhelmingly positive about the experience of receiving feedback on their prescribing practice (Table 3, topic 3.3) and about pharmacists providing this feedback, perceiving them as highly knowledgeable about medications and the prescribing process (Table 3, topic 3.4). Participants described the kinds of characteristics of the person giving feedback that they felt underpinned a positive feedback conversation, which included being relaxed, nonjudgemental and supportive in their approach (Table 3, topic 3.5). Participants reported that reviewing the video as part of the feedback session had been very beneficial and provided novel insights (Table 3, topic 3.6). The video provided insights

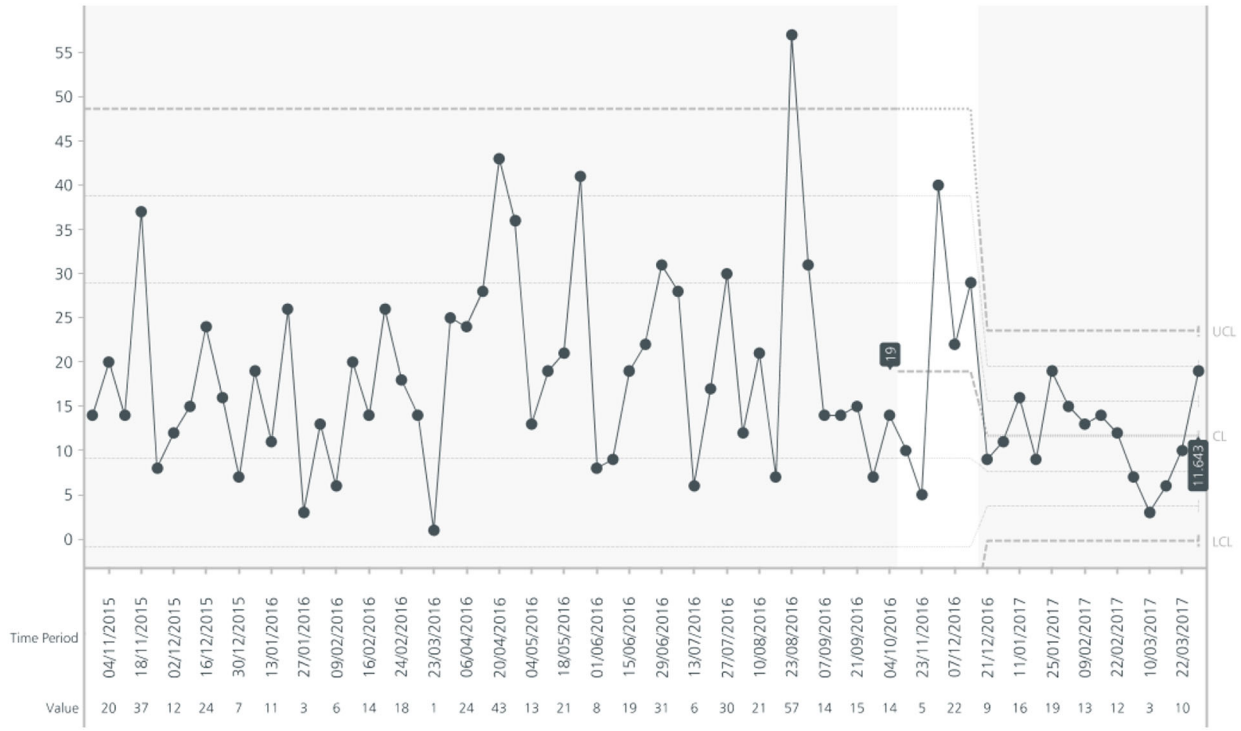

FIGURE 1 Statistical process chart showing pharmacist interventions per day (each equating to a prescribing error) over 18 months on the surgical admissions unit. The dates are given on the X-axis. The *test* phase is shaded white and is when the initial pulse of the intervention was carried out. The *baseline* data, to the left of this, was collected before the project. The *sustain* phase, to the right of this, is when the remainder of the participants took part in the intervention. The horizontal lines in the baseline and sustain phases show the mean, with lines above and below this representing 1, 2 and 3 sigma from the mean. The 3 sigma from the mean lines are also called the upper and lower control limits. These statistics show that the mean has significantly reduced in the sustain phase and the variance (sigma) has also reduced, since the lines are closer together

TABLE 1 Data showing the changes in pharmacist intervention rates and therefore prescribing errors, each reflected by a pharmacist intervention, at baseline and after the feedback intervention

	Baseline (over 50 days)	Project (over 23 days)	Percentage reduction
Number of patients	682	241	-
Number of pharmacist interventions	950	269	-
Average pharmacist interventions per day	19.0	11.7	38%
Average pharmacist interventions per patient	1.39	1.12	20%

into social complexity that drug chart review alone could not achieve and highlighted the degree of interruptions inherent in their clinical practice. Most participants noted the busy environment in which they wrote up the drug chart, and how often they were interrupted, which was evident from the film footage (see Table 3, quote 3.6.1). Some also reflected on their communication skills when taking a history with the patient. Many participants reported that they already had, or intended to, change their behaviour as a result of the intervention (Table 3, topic 3.7).

4 | DISCUSSION

The aim of this project was to develop and evaluate a feasible, authentic prescribing feedback intervention, facilitated by a pharmacist, for doctors-in-training to reduce prescribing errors. To date, there has been limited research focusing on providing structured prescribing feedback for doctors-in-training in a way that is *close to* everyday practice.[23] We demonstrated that the video-stimulated feedback initiative for doctors-in-training was associated temporally with a statistically significant reduction in pharmacist interventions, each equating to a prescribing error.

Participants felt that the design features built into the intervention (e.g. authentic task, authentic environment, feedback on prescribing, feedback by pharmacist) had enabled them to identify errors, reflect on them and commit to behaviour change to avoid them. Although they tended to be aware of the camera, this did not appear to detract from the beneficial effects of the exercise. One common observation by participants on reviewing the film footage was the busy, distracting locations chosen by doctors-in-training to prescribe medicines and complete documentation. The vast majority of doctor participants used the nurses' station, in the middle of the surgical admissions unit, to sit or stand at and complete documentation or drug charts, and this is common practice on hospital wards in many UK hospitals. However, this location is fraught with inherent distractions and human factors,

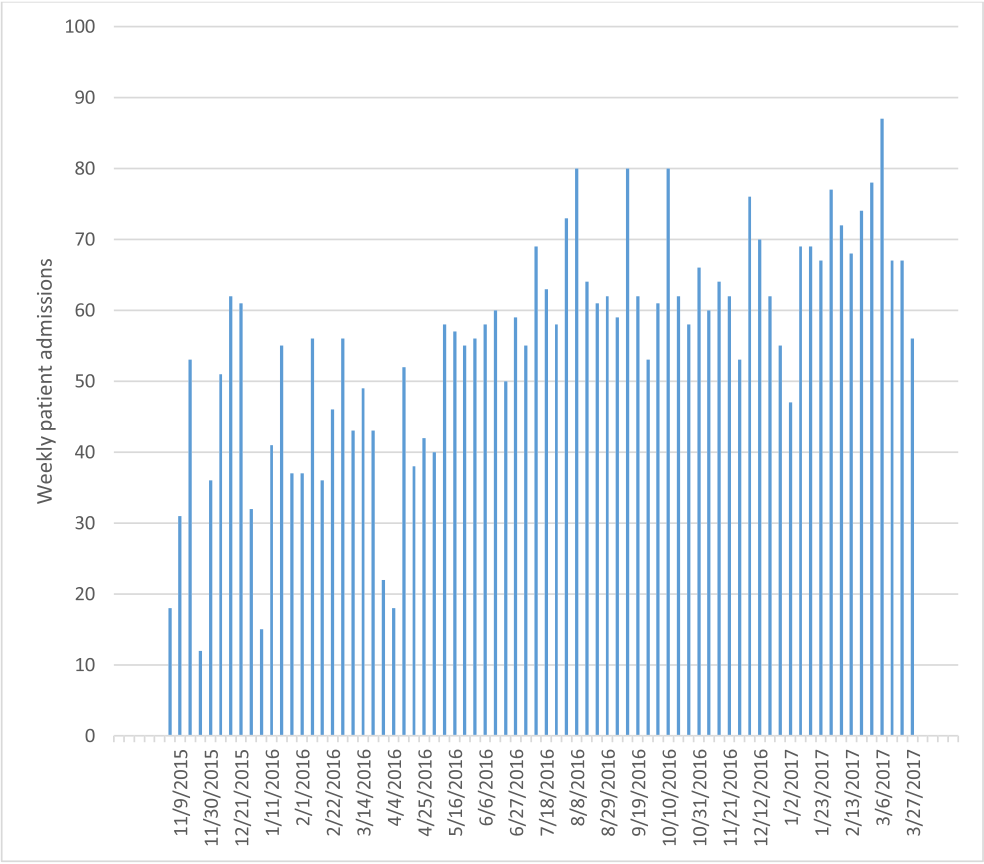

FIGURE 2 Weekly patient admissions data for the surgical admissions unit over the same time period as the statistical process chart in Figure 1, demonstrating an overall increasing trend (mean weekly admissions is 51.0 during the baseline period, 62.8 during the test period and 69.1 during the sustain period)

TABLE 2 Examples of errors in the 4 different categories that were discovered and corrected during the project

Potentially fatal
• 83-year-old woman incorrectly prescribed 80 mg of bisoprolol (a relatively potent β-blocker) once a day by an FY1 doctor. This should have been propranolol (a less potent β-blocker). This was spotted and corrected by a pharmacist before it could be given to the patient. Giving such a high dose of bisoprolol would have resulted in profound bradycardia (slow pulse) with hypotension (low blood pressure) and could have led to serious cardiac conduction abnormalities, potential cardiac arrest and death.
Serious
• 67-year-old man incorrectly prescribed Morphgesic (prolonged release morphine) 180 mg twice a day. This was spotted and corrected by a pharmacist before it could be given to the patient. Inappropriately high doses of opioids can lead to bradycardia, respiratory depression and hypotension requiring administration of an antidote.
Significant
• 94-year-old man, with a history of atrial fibrillation, was prescribed apixaban 2.5 mg once a day. This should have been twice a day as per his drug history. This was corrected by the pharmacist.
Minor
• 74-year-old man prescribed ondansetron 4–8 mg oral or intravenously when required as an antiemetic. However, no frequency or minimum dosing interval was specified. This was corrected by the pharmacist.

including diverse clinical staff, patients and carers, phones, radios, and alarms. As a result of our project, some participants reported trying to utilise an office space as a result of watching back the video footage, away from the distractions and interruptions of the nurse's station. Anecdotally, the use of this office by doctors-in-training increased over the project timeline and has continued since as practice *handed-on* to new doctors-in-training rotating into this setting.

Previous research has highlighted the high frequency of workflow interruptions in hospital settings for a range of professionals, particularly in settings such as the intensive care unit and emergency

TABLE 3 Excerpts from semistructured interviews with doctors-in-training. Each participant had a unique code. The first part of the code denotes their grade and the last part denotes their sex. Thus, the code "F1A-F" reflects a foundation year 1 (F1) participant who is female

Topic	Exemplar quotes
3.1. Acceptability of intervention	3.1.1 *"I wasn't really bothered [about the video] … I probably did a much more thorough job because I knew I was being videoed … but it didn't really bother me."* F1B-M. 3.1.2 *"She [the patient] didn't mind that I was being filmed at all."* F1B-F.
3.2. Authenticity of intervention	3.2.1 "*I'd rather have known the patient and known what they're in with, but actually it's the same as in clinical practice, we often have to just take a drug history isolated from anything else.*" F1A-M. 3.2.2 "*So like taking isolated drug history felt a little bit more forced, because … you can normally put medications into context, so like I'll know a bit more about their medical background, so you can think about why they might be taking these ones, whereas taking it in isolation is difficult … a bit more challenging maybe … more artificial.*" F1A-F.
3.3. Experience of feedback	3.3.1 "*It was really useful actually [the feedback session]… we don't often get a huge amount of feedback as F1 s.*" F1B-F. 3.3.2 "*Although you get lots of interaction with pharmacists on the wards, them picking up different drugs you prescribe, it's sort of nice to hear positive feedback as well, it's like reinforcement of what you are doing right.*" F1A-F. 3.3.3 "*I've never had that area of my clerking reviewed scrutinised or supervised in any way.*" CT1A-M.
3.4. Receiving feedback from pharmacists	3.4.1 "*I've obviously been involved with quite few pharmacists on the ward … their knowledge base is far, far superior to what I probably will ever have … they are all very nice as well.*" F1B-M. 3.4.2 "*Particularly when it comes to prescribing, they're [pharmacists are] the first line people who I ask for advice, so it makes sense that they are the ones who feedback. And they are the ones who check our drug charts, you know day-to-day, so probably have the most accurate opinion of our … prescribing … And the pharmacists have such a bulk of prescribing knowledge, more so than doctors.*" F1B-F.
3.5. Characteristics of a feedback provider	3.5.1 "*You're more open to it [feedback] if you're relaxed rather than taking it as a criticism, than getting more defensive. And it's more a discussion about trying to improve than saying you've got this wrong.*" F1B-F. 3.5.2 "*It was nice to be fairly reassured that I wasn't doing anything horrendously wrong … for the most part and a couple of things that [the pharmacist] picked up I didn't know and are good to take forward.*" F1B-M.
3.6. Participant reflections on filming	3.6.1 "*Probably the thing I think I learnt the most was watching how many times I got interrupted whilst prescribing. A drug chart is what 10 minutes I think I got interrupted 12 times during the process.*" F1B-M. 3.6.2 "*You don't realise quite how many things there are that could distract you from your focus in the clinical environment.*" F1A-M. 3.6.3 "*Seeing yourself with patients is always interesting, things like how much eye contact you give them … we always think we are giving them more eye contact than we are.*" F1A-M. 3.6.4 "*It is interesting. I think there were a couple of times when I sort of heard what I wanted to hear … you know, they [patients] start struggling and you kind of correct it for them and the danger is they're trying to say something else entirely.*" CT1A-M.
3.7. Commitment to behaviour change	3.7.1 "*After the film I think I then thought perhaps next time I'm writing a drug chart I should try to make more of an effort to go somewhere I'm not going to be distracted as opposed to sitting at the front desk where everyone comes up to you and asks questions.*" F1A-F. 3.7.2 *"I do now try and step away … unfortunately [X ward] don't have an office … so it's more a case of hiding in the treatment room. But I'm more conscious of it."* F1B-F. 3.7.3 "*We get used to doing things in a hurry. Even when you're not in a hurry, sometimes do things more quickly than you need to. You develop practices that you continue doing even when you don't need to do them.*" F1A-M.

ward.[30,31] One ward-based observation study suggested that paediatricians were disrupted 4.7 times on average per hour, by medical colleagues (30.2%), nursing staff (29.7%) and telephone/beeper calls (16.3%), leading to recommendations concerning work re-design.[32] In a retrospective review of patient safety event reports involving interruptions of clinical activities, medication tasks were mentioned most frequently (50.9%), with the most common medication error being wrong dose administration (14.4% of total medication-related errors).[31] A recent review of interruptions in the context of nursing medication administration in hospital settings concluded that interruptions are likely to occur at least once during nursing medication administration processes in hospital settings.[33] These authors recommended that individuals and organisations adopt interruption management strategies to decrease prescribing errors and increase task efficiency.

The most important impact of the feedback intervention is the reduction in prescribing errors that can lead to significant patient harm but there were other benefits too. Providing feedback to doctors-in-training in a supportive way (as in this study) can help them to feel valued in the workplace, and confident in their trajectory towards the next stage of medical training. This is important in light of alarming reports of mental ill-health in doctors-in-training—and lower proportions of doctors continuing directly into the next stage of training 2 years after graduation in the UK.[34]

4.1 | Strengths and limitations

As with all projects, there are strengths and limitations. The strengths are that: (i) the project builds on previous descriptive research[15] to make an evidence-informed intervention in an authentic clinical setting for a critical group of prescribers; (ii) the multiprofessional project team (comprising pharmacists, a surgeon, a medical educator) worked closely together to bridge the theory-practice gap, which is a formidable barrier to the implementation of research in practice; and (iii) resource limitations of the clinical environment were carefully considered and taken into account by co-designing an intervention that would be feasible to implement in this setting. In this way, we have successfully introduced a feasible low cost, acceptable intervention to a busy clinical environment and made a tangible impact on healthcare outcomes. The limitations of this project are that it involves 1 unit at a single UK hospital; feedback was predominantly given by a single pharmacist; and there was no observation component to the study to corroborate reported changes to prescribing practices that might underpin the observed decrease in prescribing errors, although the qualitative evidence supporting this interpretation was compelling. There was also no denominator for the number of medication orders written (so we have had to assume that stable or increasing patient numbers means a stable or increasing number of medication orders) and the relatively limited follow-up time means that the persistence of the feedback intervention effect is relatively underexplored. Furthermore, since doctors-in-training in the UK typically rotate between wards every 4 months, the intervention would ideally run at least 3 times per year, to maximise the impact, even though it is likely that much of the learning will be transferable between settings.

4.2 | Recommendations for practice and future research

During the project, increasing numbers of doctors-in-training were reported to be utilising quieter spaces within the clinical environment when completing drug charts, where possible. We recommend that this practice is actively supported, encouraged by more senior clinicians and enabled by the design and configuration of clinical areas. Other research suggests that feedback as a way of reducing prescribing errors should be part of a multifaceted approach.[35] Our study supports the idea that feedback outside of a supportive environment (e.g. where feedback is not seen as supportive, or there is no support provided for behaviour change) could be ineffective or even have unintended consequences. It also became clear during the feedback sessions that we simply do not praise the work of our doctors-in-training enough and focus instead on lapses in judgement and errors. We propose that educational interventions need to change to emphasise support and the development of doctors-in-training. This may positively impact the workplace culture. Future research could include larger implementations and evaluations of this feedback intervention to explore the impact of involving a wider group of pharmacists in giving the feedback, verify the findings in other clinical settings and explore the wider adoption and spread of this initiative; further development work to optimise the feedback intervention,[36] which might include exploring the role of interprofessional learning; and exploring the potential financial savings that might result from prescribing error prevention. Other professions and undergraduate students might also benefit from a similar intervention.

4.3 | Conclusions

Video-stimulated reflection on prescribing events for doctors-in-training, supported by tailored pharmacy feedback, significantly reduced prescribing errors and was well received by participants. Wider implementation of the initiative would be likely to lead to further reductions in prescribing errors and support the development of doctors-in-training.

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COMPETING INTERESTS

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CONTRIBUTORS

H.P., A.H., R.B. and K.M. conceived and designed the study. O.F., R.B. and K.M. collected and analysed the data, with O.F. and R.B. focussing on the quantitative data and K.M. focussing on the qualitative data. H.P. was responsible for preparing successive drafts of the manuscript. All authors approved the final manuscript for publication.

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SUPPORTING INFORMATION

Additional supporting information may be found online in the Supporting Information section at the end of the article.

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